Storage and Handling Procedures for RPC Components and Subassemblies (Gaps, Modules and Half-Octants) in the RPC Factory

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1.0 Purpose

The purpose of this document is to define the procedures to be adhered to for storing PHENIX Resistive Plate Chamber (RPC) raw materials, gaps, modules and half octants as these components evolve through the various stages of assembly and test at the PHENIX RPC Factory (hereinafter referred to as the Factory). These procedures will ensure

- 1.1 the safety of all personnel from risks associated with the storage and handling of RPC raw materials, gaps, modules and half-octants,
- 1.2 integrity, security and protection of the various RPC components while in storage and during handling operations
- 1.3 the adequacy of design of fixtures, tools and other apparatus to be used in conjunction with the storage and handling requirements of the RPC components

2.0 Responsibilities

The first level of responsibility rests with the Factory personnel who are responsible for handling RPC components and placing such components into appropriate storage environments at the various stages of assembly.

At all times when RPC components are being handled and/or stored first level responsibilities are as follows:

- 2.1 Insure that RPC components are handled properly and with the proper equipment as described herein
- 2.2 Insure that RPC components are stored as described herein and under conditions as described herein
- 2.3 Insure that equipment used to handle and store

The second level of responsibility rests with the RPC management. It is the responsibility of the RPC management to assure that the appropriate equipment and resources are available to allow factory personnel to comply with their responsibilities, and that related procedures defining operation of electronics and gas supply systems are uniformly adhered to.

3.0 Prerequisites

All equipment and tools involved in the handling and storage of RPC components shall be appropriately reviewed and approved by PHENIX Engineering, and shall meet all applicable standards and regulations for BNL, CAD and PHENIX.

4.0 Standard Operating Procedures

Storage and handling procedures for the RPC's can be logically divided into procedures for dealing with "gaps", "modules", and detector unit assemblies. These are defined as follows:

"gaps" are the active components within the RPC detectors, which are received at the Factory as sealed enclosures with high voltage and and gas fittings to communicate with the internal gap structure. Therer are several different size gaps corresponding to their locations within the larger unit assemblies.

"modules" – two similar sized gaps are assembled sandwich style within a aluminum structural support enclosure to form a module. There are several different sized modules corresponding to their radial locations within the detector unit assemblies.

Detector unit assemblies – these are half octants, sixteen of which make up station 2 and/or station 3 RPC detector arrays, or full octants, eight which make up station 1A and/or 1B detector arrays. In either case a detector unit assembly makes up the largest items handled in the RPC factory and are themselves comprised of 3 modules (station 3) or 2 modules (station 1) as well as structural aluminum support and enclosure structure. (Note: station 2 is not currently in the overall detector plan but could be in the future. In any case, storing and handling of the various levels of assembly would be identical to the methods described herein. Whenever the text in this document refers to "half-octant", it should be understood to apply equally to station 2 and 3 half octants and/or station 1, A and/or B, octants.)

3.1 Handling and Storing Gaps

Gaps will be received as multiple integral units in shipping crates from RPC group sources external to the Factory. When received they will be uncrated by hand. They are light enough and rugged enough to be handled by a single person but their slender shape and large surface area would make it more practical for 2 persons to handle them. Lint free clean gloves shall be worn to protect both the handlers and the gaps themselves. Gaps may be moved about the factory to the cosmic ray stand (see Factory overall layout in figure 1 and Factory tent layout in figure 2) or to assembly and bench test/repair stations within the Factory by hand as described or placed on a rolling cart.

After initial testing, when the gaps need to be stored until needed for assembly into modules, the gaps shall be placed on steel and wood shelves stacked no higher than 10 per shelf, in a humidity controlled environment. The gaps, at the descretion of the RPC group management, may have clean gaseous nitrogen or argon flowed through them in an open loop system with the return gas exhausted

through an exhaust manifold terminationg on the outside of the building. The shelves so equipped are depicted below in figure 3. The location of these shelves is shown in figure 1.

3.2 Handling and Storing Modules

Modules are handled essentially the same as gaps. Due to their structural components and the internal assemblage of 2 gaps, the modules are significantly heavier, but also significantly more robust. Due to their increased weight, modules must be handled by 2 persons when lifting and positioning, but may also be transported using a rolling cart.

Modules are to be stored in the same shelving as the gaps, except modules are limited to stacks of 5 on individual shelves. Modules may use the same inert gas flow and external humidity control system as the gaps or no internal flow at all during storage as determined appropriate by the RPC group management overseeing these operations.

3.3 Handling and Storing Detector Unit Assemblies

The half-octant (and later the station 1 octant) detector unit assemblies will be fabricated on a mobile tilt table custom designed for assembling and transporting these assemblies within the Factory. The mobile tilt table concept is shown in figure 4.

The same table will be used to transport half octants when being relocated within the Factory. This table tilts to a fully vertical position from which the half octants can be loaded or unloaded into the burn-in test stand for burn in-tests. After

3.4 Preparation for Installation

Appendix A: List of RPC experts

Contact Information

Contact Information for experts for this subsystem can be found on the PHENIX Internal Website in the [RUN] link at: (NOTE: replace ## by the current run number)

https://www.phenix.bnl.gov/WWW/run/##/contacts/subsys_experts.html

General PHENIX contact info can similarly be found at:

https://www.phenix.bnl.gov/WWW/run/##/contacts/

Gas system experts can be found at:

http://phenix.bnl.gov/WWW/tracking/gas_system/people.html

In addition, the Run Coordinator and Shift leader for the current run shall have a paper copy available of the contact information for the appropriate systems experts for this and all other PHENIX subsystems.